

REMARKS

After the foregoing amendments, claims 1-4, 6, 7, 9-16, 18 and 19 are pending in this application. By this reply, Applicants have amended claims 1, 12, 14 and 18, without prejudice. The specification has also been amended to correct typographical and grammatical errors. No new matter has been added by these amendments.

Objections to the Specification

The Specification has been objected to due to minor typographical errors. Applicants have amended the specification to include the Examiner's recommendations as well as to correct other typographical and grammatical errors. In addition, paragraph [0046] of the specification was amended to reinsert the identification of Applicant's bacterial deposits. This amendment was originally made in a Preliminary Amendment filed on August 3, 2005, and was inadvertently omitted from the substitute specification filed on April 28, 2006. A second substitute specification (clean copy and marked-up version) is enclosed to reflect all changes in the specification. The marked-up version shows the changes made relative to the substitute specification filed on April 28, 2006. Applicants respectfully request withdrawal of the specification objections.

Claim Objections

The previously submitted version of claims 6 and 9 was objected to for containing typographical errors, and were considered by the Examiner to be

unchanged. Claims 6 and 9 have been corrected as set forth in the claim listing above, and remain unchanged from the originally filed version.

Claim 18 was objected to for failing to limit the subject matter of claim 12, from which it depends. Claim 18 has been amended to depend from claim 14, and is believed to overcome this rejection. Accordingly, Applicants respectfully request withdrawal of the present claim objections.

Claim Rejections under 35 USC § 112

Claims 1, 12, 14 and 18 have been rejected under 35 U.S.C. § 112, second paragraph, as indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1 and 14 were stated to be indefinite for having a broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation. In particular, the Office Action states that independent claims 1 and 14 recite the broad recitations *Bacillus licheniformis*, *Bacillus subtilis*, and *Bacillus amyloliquefaciens*, and the claims also recite the narrow strains PMBP-m5, PMBP-m6, and PMBP-m7. As identified in the specification of present application, three *Bacillus* strains of the present invention were isolated and deposited in ATCC, and each was assigned a unique ATCC Accession No. Applicants have amended claims 1 and 14 to properly identify these microorganisms by their ATCC Accession Nos. in order to overcome this rejection.

Claims 1 and 14 were also rejected as indefinite for reciting the acronym PMBP. Applicants have deleted the acronym PMBP and accordingly request withdrawal of the rejection as well.

Claims 1 and 14 have also been rejected as indefinite for being unclear. The claims previously contained the Markush group, “which are isolated from one of a fiber plant and a livestock excrement compost.” Applicants have deleted this Markush group from Claims 1 and 14 and defined the claimed microorganisms as the specific microorganisms isolated by the inventors to overcome this rejection. Withdrawal of this rejection is respectfully requested.

Claim 2 has been rejected for reciting insufficient antecedent basis based on the claimed phrase, “said fiber plant”, because this phrase is recited twice in claim 1. Applicants have amended claim 1 to clarify this term, and withdrawal of this rejection is respectfully requested.

Claims 12 and 18 have been rejected as being indefinite because the phrase “under 120°C to 150°C” recited in claims 12 and 18 is stated to be unclear. In accordance with the disclosure in the specification, claims 12 and 18 have been amended to recite “within 120°C to 150°C”.

In view of the above, withdrawing the objections on Claims 1, 2, 12, 14 and 18 of the present application under 35 USC § 112 is respectfully requested.

Claim Rejections under 35 USC § 103(a)

Claims 1-3, 6-7, 9-16 and 18-19 stand rejected under 35 USC 103(a) as being obvious over Akhtar (US 6,402,887) in view of Sweeney (US 1,639, 152), Schulein et al (U.S. Patent 6,387,690) and Jeffreys (US 2,766,176). Claim 4 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Akhtar, Sweeney, Schulein, and Jeffreys, and further in view of Blanchette (US 5,427,945). Applicants respectfully traverse this rejection for the reasons set forth in detail below.

Claims 1 and 14 of the present invention recite a biopulp that is produced from a non-woody fiber plant using one of a *Bacillus licheniformis* having been deposited under ATCC Accession No: PTA-5824, a *Bacillus subtilis* having been deposited under ATCC Accession No: PTA-5818 and a *Bacillus amyloliquefaciens* having been deposited under ATCC Accession No: PTA-5819. These are particular micro-organisms of the genus *Bacillus* that were isolated by the inventors. Isolation of these particular micro-organisms was not previously attempted or achieved, and Applicants respectfully submit that the cited references do not suggest or disclose a biopulp produced using these particular micro-organisms.

These distinct *Bacillus* microorganisms directly generate the biopulp without any purifying treatments. The *Bacillus* strains do not require heat treatment because there is no antagonistic effect between the particular micro-organisms of the genus *Bacillus* and natural microorganisms when the particular micro-

organisms of the genus *Bacillus* are applied on the plant material. Since there is no antagonistic effect, decomposition will not be affected which reduces the cost for producing the paper pulp. The decomposition abilities of the three *Bacillus* strains on the plant material are also advantageous over those created by heat treatments or other comparative species. Paragraphs [0040]-[0042] of the present application provide comparative data which is summarized in Fig. 1.

Akhtar discloses a biomechanical or kraft pulping process. The pulping process uses wood chips for producing a paper pulp by inoculating the wood chips with white-rot fungus, i.e. *Ceriporiopsis subvermispora*, which is distinct from the particular micro-organisms from the genus *Bacillus* recited in independent claims 1 and 14 of the present invention.

The wood chips in Akhtar receive a purifying treatment before inoculating the white rot fungi. The purifying treatment is a heat treatment which decreases or eliminates the population of other microorganisms to enhance the white-rot fungi growth and generate a dominant population in the wood chips. Claims 1 and 14 of the present invention are further distinguishable from Akhtar because the recited *Bacillus* microorganisms directly generate the biopulp without any purifying treatments, such as heat treatment. As described in the specification of the present application, white-rot fungi are commonly used for removing the lignin of woods in the paper-making industry (see paragraph [0005]). It is well known that

inoculating the white-rot fungi on wood outdoors is complicated and time intensive (see paragraph [0005]). It is also well known that a major limitation of white-rot fungus is its sensitivity to biological process operations. In addition, fungus does not grow well in suspended cell systems. Accordingly, the *Bacillus* microorganisms recited in claims 1 and 14 of the present invention are distinguishable from Akhtar.

Akhtar also discloses that heat treatments are necessary to reduce the population of naturally occurring microorganisms which inhibit growth of the white-rot fungi either directly or competitively for establishing a suitable environment for white-rot fungus growth. These additional heat treatments raise the overall cost of the process. The methods of claims 1 and 14 of the present application are advantageous over Akhtar because a further heat treatment is not required, which simplifies the process steps.

Finally, the particular micro-organisms of the genus *Bacillus* in the presently claimed invention are not harmful to the environment so that they will not damage the environment and the human body. However, it is possible that the white-rot fungus in Akhtar's patent is a pathogenic species, which could damage the environment, potentially causing disease on woods or fruits.

With respect to Sweeney, this patent discloses submerging a corn stalk in a water tank, and fermenting the corn stalk with naturally existing microorganisms in the environment, as opposed to using the particular micro-organisms of the genus

Bacillus recited in claims 1 and 14 of the presently claimed invention. It is well known that the spectrum of microorganisms naturally existing in the environment include are any possible microorganisms, such as those which could harm the human body and/or the environment after bulk proliferation. To the contrary, the present application utilizes specific, safe and controllable microorganisms so that there is no damage to human health or the environment. There is no teaching or suggestion in Sweeney to use the specific *Bacillus* strains disclosed in the present invention.

With respect to Schulein, this patent discloses enzyme preparations consisting essentially of an enzyme which has cellulytic activity, and DNA constructs encoding such enzymes. Schulein discloses treatment lignocellulosic material, such as pulp or paper, with such enzymes. The biopulp of the present application is distinguishable because it produced by using microorganisms rather than enzymes with certain sequences prepared by *Bacillus*. Further, one ordinarily skilled in the art would recognize that enzymes are sensitive to temperature. The digestion ability of enzymes is typically much more reduced at higher temperatures at which microorganisms generally survive and function. Accordingly, Schulein is distinguishable from the present invention because there is no teaching or suggestion to use the particular micro-organisms of the genus *Bacillus* recited in claims 1 and 14 of the present application, as amended.

Jeffreys is directed to a process for culturing anaerobic bacteria to produce growth promoting substances, such as “B-complex vitamins, antibiotics, and enzymes of economic and industrial importance” Jeffreys expressly states that anaerobic bacteria are combined with aerobic bacteria in a synergistic relationship wherein “the actively growing aerobes provide the requisite anaerobic conditions for the growth and propagation of the anaerobic organisms.” *See Jeffreys at col. 2, lines 54-70.* This specific combination of anaerobic bacteria and aerobic bacteria requires a carefully maintained environment to control oxygen/carbon dioxide levels (*see col. 5, lines 22-52*). Furthermore, the synergistic combination of anaerobic bacteria and aerobic bacteria create an oxidation-reduction potential to create an environment conducive to growth of the anaerobic bacteria (*see col. 5, lines 22-52*). In particular, Jeffreys uses the aerobic bacteria to provide a suitable environment to preserve the anaerobic bacteria (*see col. 6, lines 14-28*).

Jeffreys is distinguishable from the present invention namely because Jeffreys does not teach or suggest using bacteria in a paper making process. Rather, Jeffreys is directed to a process for producing growth promoting substances identified above. Furthermore, Jeffreys expressly requires a synergistic combination of anaerobic bacteria with aerobic bacteria to provide a suitable environment for the anaerobic bacteria to grow and produce these beneficial substances. This is distinguishable from the present invention because the claimed

Bacillus strains are aerobic bacteria, and anaerobic bacteria are not taught or suggested for use in the claimed process. Furthermore, the aerobic bacteria of the present invention are not used to balance the culture solution to preserve anaerobic bacteria. The conditions required to support the synergistic combination of anaerobic bacteria and aerobic bacteria disclosed in Jeffreys require additional steps and complexity, as opposed to the claimed biopulping method.

In summary, independent claims 1 and 14 have been amended to recite particular microorganisms of the genus *Bacillus* which are neither taught nor suggested in any of the cited references, taken alone or in combination. Based on these amendments and the above noted differentiations between the present invention and the cited prior art, Applicants respectfully request withdrawal of the rejections of claims 1 and 14. Claims 2-3, 6-7, 9-13, 15-16 and 18-19 are dependent upon claims 1 and 14, and are distinguishable for the reasons the same reasons discussed above with respect to claims 1 and 14.

Double Patenting

Claims 1 and 14 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 2 of copending U.S. Application No. 10/785,884. A Terminal Disclaimer is submitted herewith to overcome this double patenting rejection. Withdrawal of this obviousness-type double patenting rejection is respectfully requested

Applicant: Huang et al.
Application No.: 10/783,550

Conclusion

If the Examiner believes that any additional minor formal matters need to be addressed in order to place this application in condition for allowance, or that a telephone interview will help to materially advance the prosecution of this application, the Examiner is invited to contact the undersigned by telephone at the Examiner's convenience.

In view of the foregoing amendment and remarks, Applicant respectfully submits that the present application, including claims 1-4, 6, 7, 9-16, 18 and 19 is in condition for allowance and a notice to that effect is respectfully requested.

Respectfully submitted,

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